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(54) Title: FIRE SUPPRESSANT FOAM DISPERSANT AND DETERGENT ECKHARD III-FORMULA

(57) Abstract

This invention relates to a foam fire suppressant, dispersant and detergent composition containing an emulsifier surfactant, a coconut fatty acid, a vegetable distilled fatty acid, a nonionic and ionic surfactant, a wetting agent surfactant, a heat transfer agent, a detergent builder surfactant, a food coloring agent, a pH control agent, distilled water, and a freezing point depressant. The composition acts as a fire suppressant foam generator, an oil and flammable liquid dispersant and detergent. It is biodegradable and breaks down fuel spills as well as the fuels which it extinguishes. The composition of the present invention is also useful as a detergent for clean-up of equipment after a spill or fire involving hydrocarbons, and furthermore useful as a detergent for general household cleaning.

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FIRE SUPPRESSANT FOAM DISPERSANT AND DETERGENT
ECKHARD III-FORMULA

The present invention relates to fire suppressing compositions and more particularly to detergent containing suppressant compositions which act as dispersants of oily and hydrocarbon liquids.

The fire-suppressant detergent and dispersant composition of this invention is a combination of ingredients which produces a foam substance that will extinguish common combustibles and flammable liquid fires as a fire suppression agent. The foam substance reacts by covering the fire and flammable liquid surface, by providing a coating which prohibits vapor from being released by fuels, and inhibiting the oxygen supply to the fire. The formulation will resist being disrupted by flame, wind, thermal updraft and most importently hydrocarbon attack. The foam system will flow around objects to cover areas which are difficult to reach and is capable of establishing a stable foam blanket which will re-seal itself when its surface is disrupted. The foam will achieve a cooling effect because of its water content around the foam bubbles along with its membrane as the substance is applied to heated metal surfaces. The foam bubbles retain the water content within the foam, making the formulation more adhesive and resistant to flashback due to deterioration from the fire or heat exposure. The low drainage and clingability on curved and vertical surfaces also adds to the favorable characteristics. If foam of this invention is applied to class "A" and to class "B" flammable liquid fires, it has a quick knock down, an exellent vapor seal and unique clingability characteristics. The formulation is helon and fluorocarbon free, non-corrosive, and performs equally well with fresh or sea water. The substance then reacts as a dispersant in a process of breaking down the properties of the fuels which it extinguishes.

The formulation is a colloidal system which works by means of micelles, e.g. a submicroscopic aggregation of molecules such as a droplet in a colloidal system. The micelles repel each other in a ceaseless, random movement. The colloidal action penetrates into dirts, greases, or oils, each micelle occludes with a particle of the dirt or oil and the individual particles disperse and continue to repel each other so that they loose the ability to recoalesce or redeposit on the surface. The formulation penetrates any porous surface to reach any oily mass and breaks it down to smaller size particles, quickly, safely and with no damage to the environment.

When used as a detergent, the biodegradable, non-toxic cleaner is applied like any other conventional cleaner, including power spray application, designed for a specific purpose application, and a specific concentrate or super concentrate ratio to water is applied prior to use. The detergent is antistatic and contains an antibacteriostat.

When used as a detergent cleaner, the non-toxic, non-corrosive, non-abrasive, phosphate, ammonia and chloride free cleaner is applied with sponge, cloth or brush.

When used as a biodegradable non-toxic oil and flammable liquid dispersant, the formulation is applied by conventional existing oil and flammable liquid spill equipment. The properties of the formulation allow it to be used for a wide variety of such applications. The formulation does not contain any caustic material.

As an oil and flammable liquid dispersant it can be applied by the most common pressure equipment found aboard ships, boats and tugs. The existing fire fighting system on board provide the most effective means both to apply the dispersant, and to supply the necessary agitation for successful dispersion. This eliminates the dependency upon rough sea conditions for agitation. The dispersant should always be applied directly on or into spilled oil or flammable liquid, in a solid stream especially if the spill is moving towards a shore line or other ecologically sensative areas.

As an oil and flammable liquid land spill dispersant and clean up agent, and to prevent ignition of flammable liquids, it can be applied via induction with the most common pressure equipment available to fire supression agencies.

Fire suppressing compositions known in the fire fighting industry are generally divided into chemical foams and mechanical foams. The purpose of covering the fire surface by foam is to form a substantially homogenous mask of minute air in an aqueous foam which resist separation and rupture caused by winds, flame, etc;, which is capable of re-sealing itself, and which is liquid enough to flow around objects, reaching and covering areas, which might ignite, or which are on fire. The foam blanket ideally prevents oxygen supply to the combustion area, or in the case of a flammable liquid spill, covers the liquid preventing hazardous vapor production, as well as possible ignition of the flammable liquid. The benefits of the foam blanket can be attributed, in part, to the fact, that the foam has a high water content, and creates a cooling effect on heated surfaces. The amount of moisture contained within the foam is usually measured by the foam drainage time. Foams with a high moisture content drain at a faster rate then foams with a low moisture content.

Mechanical foams are produced by aeration of an aqueous foam composition to cause entrapment of air in the aqueous phase thus forming the foam bubbles. Known mechanical foam systems contain proteins, fluoroproteins, synthetic detergents, aqueous film forming agents (AFFF), polyclycoside detergents, polysaccharide bipolymers, highly fluorinated surfactants, and pectins.

Synthetic detergent foams are characterized by their significant expansion rate (approx. 20 to 1 as compared to 8 to 1 or 10 to 1 expansion ratios for protein or fluoroprotein foams). The synthetic detergent foam has good fluidity but low stability and rapid

drainage time, as well as little radiant heat resistance and rapid dissipation. Synthetic detergent foam liquids comprise surfactants, foam stabilizers and freezing point depressants. The synthetic detergent foams do provide an insulating shield from the heat and allow fire fighters to breath and function, using a mask if necessary. Synthetic detergent foam combines the use of fluorocarbon surfactants and suitable foam stabilizers.

Protein foam is primarely manufactured by alkaline or acid hydrolysis of either vegetable or animal proteins, including hydrolysed protein solutions of soybean, peanut, feather meal, hoof meal, horn meal, blood, or fish scales. Iron salts are always added to provide heat resistance and mechanical stability to the foam bubbles. Freezing point depressants and viscosity control agents are also incorporated.

Protein foams contain various iron salts and other specialized ingredients which cause them to be both toxic and corrosive.

Fluoroprotein foam combines the use of regular protein foam base with certain proprietary fluorinated surfactants to resist breakdown by dry chemical agents. Fluoroprotein film forming foam contains fluorocarbon surfactants.

Aqueous film forming foams use both hydrolysed protein and fluorinated surfactant base plus stabilizing additives.

United States Patent 4,594,167 discloses a foam fire extinguishing composition containing protein hydrolysate and a fluorine containing surfactant.

United States Patent 4,713,182 discloses a fire suppressant foam composition containing citrus pectin and fluorine substituted thioether.

United States Patent 5,207,932 discloses fire fighting foam which includes a polyglycoside to enhance perfluoroalkyl surfactants.

United States Patent 5,061,383 discloses a detergent type mechanical foam containing surfactants derived from fatty acids.

United States Patent 4,859,349 discloses polysaccharides bound to perfluoroalkyl surfactants.

The significant disadvantage of aqueous film forming foams (AFFF) for example as disclosed in United States Patent 5,207,932 is that it is a surfactant that releases halocarbons, and the gaseous agents are divided into two categories for use as a fire suppression agent. Carbon dioxide and halocarbons, such as halon 1011, halon 1301, halon 1211, and tetrachloride, are all either toxic or oxygen depleting, and the halocarbon works to deplete the ozone layer.

The significant disadvantage of fluoroprotein foams are that they contain fluorocarbon surfactants. These fluorocarbons will release gaseous halocarbon compounds that work to deplete the ozone layer and contribute to the "Greenhouse Effect".

The principal drawback of the use of polysaccharide polymers is the need to use high amounts of polysaccharide (between 1 and 2% in the foam concentrate) to obtain a foam having good extinguishing properties on polar solvent fires. This polymer concentration increases to a very high level the foam compound viscosity. The delivery of such a viscous foam is difficult, and becomes impossible below 5 degree celsius, even at the lowest polyester concentrations usable.

The significant disadvantage of synthetic detergent foams is that, although generally less toxic, they contain phosphates that could cause eutrophication in lakes and streams. The vegetation in the water and the proliferation of algae in huge blotches of green slime can cause damage to the remainder of the marine ecosystem. They do nothing to aid the biodegration process.

Highly fluorinated surfactants have been used on polar solvent fires. This type of foam contains fluorocarbon surfactants and various foam stabilizers. It can be used with fresh water or salt water, and resists break down by dry chemical agents. The aqueous film forming foam (AFFF) has both low viscosity and surface tension, which allows it to spread over the fuel surface rapidly and extinguish shallow or deep fuel spill fires. The major draw back of this type of foam is that it has a rapid drainage time which may cause the flammable liquid to be exposed to potential ignition and re-ignition, once the foam has drained away.

Fluoroprotein foam and aqueous film forming foam all contain fluorocarbon surfactants. These foams are both toxic, especially to marine life forms, and can cause corrosion to unpainted and unprotected metal surfaces, especially to aircraft engines. While these surfactants in themselves do not harm the ozone layer, they will release gaseous halocarbon compounds that do work to deplete the ozone layer and contribute to the " Greenhouse Effect ".

Fire suppression agencies are not allowed to practice with them unless they have specialized containment and collection equipment and systems where runoff can be collected and treated. Even when collected, they are toxic to the bacteria within the collection and treatment system, and as a result most fire training schools test specific brands on their bacteria strains before they are allowed to be used in their training exercise.

These surfactants release halocarbon compounds and contributing to the greenhouse effect, making them subject to the MONTREAL PROTOCOL.

Accordingly such prior art formulations are not multipurpose.

It is also desirable to provide a fire suppressant foam suitable for use in conventional fire extinguisher containers. At present, these fire extinguishers contain sodium bicarbonate and CO2 under pressure.

SUMMARY OF THE INVENTION

This invention relates in general to a biodegradable non-toxic fire foam, a biodegradable emulsifying oil and flammable liquid dispersant, and a biodegradable non-caustic, non-corrosive, non-abrasive, phosphate, chlorine and ammonia free, all purpose cleaning agent, and more particularly to a newly developed formulation of a homogenous blend of colloids, sterilants, bacteriostatics, sequesterants, surfactants, fatty acids, freezing point depressant and hyperwetting agents applied as a class "A" and "B" fire suppressant, oil and flammable liquid spill remediation dispersant, general oil and grease clean up agent, all purpose industrial and household cleaner.

The fire suppressant foam of the present invention has positive qualities of a fluoroprotein or fluoropolysaccharide film forming foam while eliminating fluorocarbon for environmental reasons. It was found that 3 - 14% concentrations of the fire suppressant composition of this invention, converted mechanically into a water based foam, was effective as a fire suppressant although other concentrations would be used effectively depending on the type of fire.

The invention includes a fire suppressant foam concentrate tailored for utilization on flammable liquid fires, capable of being used on hydrocarbon fires, or on polar solvent fires, and specifically formulated to meet the requirements of an international treaty signed in Montreal, Canada on September 16, 1987, known as the Montreal Protocol, to phase out halogenated fire supression agents.

01 COMPONENT DESCRIPTION (Fire Suppressant Foam Dispersant and Detergent)
02 in accordance with this invention.
03 (a) * Alkamide DC-212S (Rhone Poulenc, Inc.) formerly Cyclomide 212,
04 Coconut fatty acid diethanolamide;

05 (b) * Amphosol CA (Stephan Company) betaine amido propyl-N
06 dimethylamino acetic acid (C2 - C6 amino acid);

07 (c) * Makon-10 (Stephan company) nonionic sanitizing and destaticizing
08 hydrophilic alkoxylate ethelene oxide, to hydrophobic nonyl phenol, (C2 - C4 alkoxylate);

09 (d) Propylene glycol;

10 (e) * Rhodapon LCP-30% \ SM-40% (Rhone Poulenc, Inc.) formerly Sipon-SM
11 Sodium lauryl sulphate;

12 (f) * Tergitol 15S9 (Union Carbide) family of Polyethelene glycol ethers. H (CH2) 11-15 O
13 (CH2CH2 O) xH alkyloxy polyethelene oxyethanol (x having from 7-10 moles of CH2CH2 O);

14 (g) * Triton H66 (Union Carbide) anionic surfactant
15 Alkylarylalkoxy potassium salt (50% strenght);

16 (h) * Triton N60 (Union Carbide) family of nonionic surfactants
17 Poly (oxy-1,2-ethanediyl), a- (4-nonylphenyl) - w-hydroxy-, branched
18 Nonyiphenoxypolyethoxyethelene;

19 (i) Food color (Mc Cormick)
20 color constitution index numbers 16035, 19140, 42090 and 45430;

21 (j) Distilled water

22 Alternate fatty acids for use in the composition include;
23 cocoanut fatty acid, * Ethofat, * Kort Acid C60, * Kort Acid C70 and * Kort Acid G70.

24 Useful surfactants include * Cyclo 21, * Cyclo 4221,
25 Lauric Acid Diethanolamide, Linear Alkyl Sulfate Sodium Salt, * Rhodapon SB-8208,
26 * Rhodapex ES, * Rhodapex N70, Sodium Dioctyl Sulfosuccinate and * Tergitol NP-9.
27 * TM

In place of surfactant (e) (* Rhodapon-SM) a sodium lauryl sulphate * Rhodapon-LCP (Rhone Poulenc,Inc) is substituted for use as lower concentration.

* Triton N101 is a substitute emulsifier for use in the composition of this invention.

An example of a heat transfer agent for use in the composition is Poly Oxyethelene Nonyl Phenelether.

DESCRIPTION IN PERCENTAGES BY WEIGHT OF PREFERRED

Fire suppressant foam dispersant and detergent concentrate form components in accordance with the present invention.

(a) 12.00 - 34.90 % emulsifier, preferably a cocoanut fatty acid diethanolamide;

(b) 1.75 - 22.00 % detergent builder, preferably of the type of an amido propyl-N amino acid, (C2 - C6 amino acid);

(c) 1.75 - 7.00 % sanitizer and destaticizing agent, preferably of a nonionic hydrophilic ethelene oxide to hydrophobic nonyl phenol (C2 -C4) alkoxylate;

(d) 1.75 - 8.00 % propylene glycol, as freezing point depressant;

(e) 1.75 - 16.00 % antibacteriostat, detergent stabilizer for low temperature clarity and uniform particle size, sodium lauryl sulphate 30% and 40% strenght;

(f) 8.75 - 25.00 % anti-corrosion inhibitor and stabilizer, (glycol ethers), preferably an H (CH2) 11 - 15 O (CH2CH2 O) xH alkyloxy polyethelene oxyethanol;

(g) 3.50 - 49.50 % wetting agent and detergent builder, anionic surfactant alkylarylalkoxy potassium salt 50% strenght;

(h) 3.50 - 12.00 % heat transfer agent, preferably a nonionic hydroxypolyoxyethelene surfactant, poly (oxy - 1, 2 - ethanediyl), a - (4-nonylphenyl) - w - hydroxy - , branched nonylphenoxypolyethoxyethelene;

(i) 0.10 - 0.50 % color code, preferably a food color having constitution index

(j) numbers 16035, 19140, 42090, and 45430;

8.00 - 65.00 % viscosity adjuster, preferably distilled water.

Following are EXAMPLES of Fire-Suppressant-Foam, Dispersant and Detergent concentrate compositions in accordance with the present invention:

34.9 % * Alkamid DC-212S, cocoanut fatty acid diethanolamide;

5.0 % * Amphosol CA, amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);

5.0 % * Makon-10, nonylphenol (C2 - C4) alkoxylate;

5.0 % Propylene glycol;

5.0 % * Rhodapon LCP-30%, sodium lauryl sulphate;

* TM

25.0 % * Tergitol 15-S-9, polyethelene glycol alkyl ethers;
10.0 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;, and
10.0 % * Triton N60, alkylphenol-hydroxypolyoxyethelene, were mixed in
a vat, and 0.1 % food coloring having constitution index number 16035 was added while mixing.

EXAMPLE 2.

ANALYTE-CSF-369WL

22.0 % * Amphosol CA, amidopropyl-N dimethylamino acid (C2 - C6 amino acid);
8.0 % * Rhodapon LCP-30%, sodium lauryl sulphate;
49.5 % * H66, alkylarylalkoxy potassium salt, 50% strenght;
12.0 % * Triton N60, nonylphenoxypolyethoxyethelene, were mixed in a vat, and
sufficient distilled water was added while the mixture was agitated, or 8.0 %.
A light red food color, constitution number 16035, was prepared and sufficient added to
obtain desired color, or 0.5 % .

EXAMPLE 3.

ANALYTE - CSF-AX14

12.0 % * Alkamid DC 212S, coconut fatty acid diethanolamide;
11.0 % * Amphosol CA, amidopropyl-N dimethylamino acid (C2 - C6 amino acid);
7.0 % * Makon-10, nonylphenol (C2 - C4) alkoxylate;
8.0 % Propylene glycol;
16.0 % * Rhodapon LCP-30, sodium lauryl sulphate;
15.5 % * Tergitol 15S9, polyethelene glycol ethers;
20.0 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;, and
10.0 % * Triton N60, alkylphenol-hydroxypolyoxyethelene were mixed in a vat;
A light blue food color, constitution number 42090, was prepared and sufficient added
to the mixture to obtain desired color, or 0.5 % .

EXAMPLE 4.

ANALYTE - HCD-8x

27.9 % * Alkamid DC-212S, coconut fatty acid diethanolamide;
4.0 % * Amphosol CA, amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);
4.0 % * Makon-10, nonylphenol (C2 - C4) alkoxylate;
4.0 % Propylene glycol;
4.0 % * Rhodapon LCP-30%, sodium lauryl sulphate;
20.0 % * Tergitol, polyethelene glycol alkyl ethers;
8.0 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;
8.0 % * Triton N60, alkylphenol-hydroxypolyoxyethelene, and
0.1 % Food color having constitution index numbers 42090 and 19140,
were mixed in a vat, and 20 % distilled water was added while agitate.
* TM

EXAMPLE 5

ANALYTE - CEC-7

24.4 % * Alkamid DC-212S, coconut fatty acid diethanolamide;
3.5 % * Amphosol CA, amidopropyl-N dimethylamino acid (C2 - C6 amino acid);
3.5 % * Makon-10, nonylphenol (C2 - C4) alkoxylate;
3.5 % Propylene glycol;
3.5 % * Rhodapon SM-40%, sodium lauryl sulphate;
17.5 % * Tergitol 15S9, polyethelene glycol alkyl ethers;
7.0 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;
7.0 % * Triton N60, alkylphenol-hydroxypolyoxyethelene, and
0.1 % Food color having constitution index number 45430,
were mixed in a vat, and 30 % distilled water was added while agitated.

EXAMPLE 6

ANALYTE - APACC-6

20.9 % * Alkamid DC-212S, coconut fatty acid diethanolamide;
3.0 % * Amphosol CA, amidopropyl-N dimethylamino acid (C2 - C6 amino acid);
3.0 % * Makon-10, nonylphenol (C2 - C4) alkoxylate;
3.0 % Propylene glycol;
3.0 % * Rhodapon LCP-30%, sodium lauryl sulphate;
15.0 % * Tergitol 15S9, polyethelene glycol ethers;
6.0 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;
6.0 % * Triton N60, alkylphenol-hydroxypolyoxyethelene, and
0.1 % food color having constitution index number 16035,
were mixed in a vat, and 40 % distilled water was added while agitated.

EXAMPLE 7

ANALYTE - APCC-4

13.9 % * Alkamid DC-212S, coconut fatty acid diethanolamide;
2.0 % * Amphosol CA, amidopropyl-N dimethylamino acid (C2 - C6 amino acid);
2.0 % * Makon-10, nonylphenol (C2 - C4) alkoxylate;
2.0 % Propylene glycol;
2.0 % * Rhodapon SM-40%, sodium lauryl sulphate;
10.0 % * Tergitol 15S9, polyethelene glycol alkyl ethers;
4.0 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;
4.0 % * Triton N60, alkylphenol-hydroxypolyoxyethelene, and
0.1 % food color having constitution index number 42090,
were mixed in a vat, and 60% distilled water was added while agitated.

* TM

EXAMPLE 8

ANALYTE - APCC-6x

12.15 % * Alkamid DC-212S, cocoanut fatty acid diethanolamide;
1.75 % * Amphosol CA, amidopropyl-N dimethylamino acid (C2 - C6 amino acid);
1.75 % * Makon-10, nonylphenol (C2 -C4) alkoxylate;
1.75 % Propylene glycol;
1.75 % * Rhodapon LCP-30%, sodium lauryl sulphate;
8.75 % * Tergitol 15S9, polyethelene glycol ethers;
3.50 % * Triton H66, alkylarylalkoxy potassium salt, 50% strenght;
3.50 % * Triton N60, alkylphenol-hydroxypolyoxyethelene, and
0.10 % Food color having constitution index number 19140,

were mixed in a vat, and 65 % distilled water was added while agitated.

FOLLOWING ARE EXAMPLES of Fire-suppresant-foam dispersant and detergent actual trials in accordance with the present invention.

3 to 6% concentrate of the mixture in EXAMPLE 1, was added to synthetic sea water to provide 20 liters of solution. The dilute solution was agitated and placed into a suction tank. A suction line from the tank was installed to a electrical driven mechanical centrifugal pump. A nozzle having an orifice with 0.071" bore, was connected to a 1" diameter discharge line. A steel pan with the following configuration 480mm by 480mm by 150mm was utilized, and 2 liters of gasoline and 1 liter of diesel fuel was poured on top of 2 cm of water into the pan. The pan was ignited, the pump was started maintaining 150Psig discharge pressure, and the fire was attacked with the foam substance and extinguished in less than 5 seconds. After fire extinguishment on open propane flame was held over the pan, close to the blanket surface, and no reignition occurred.

6 liters of EXAMPLE 1, were mixed with 194 liters of water to represent a 3 % product concentration. A sample was drawn to establish the foam drainage time, which was established as being exceptionally slow draining, with a drainage time factor of 17.06 minutes. The solution was than poured into a holding tank, and pressurized with nitrogen to 120\psig. 65 USG\246 liters of heptane fuel was poured into a steel pan containing a layer of water, at an UL approved indoor facility.

A foam maker nozzle having an output of 2 USG\7.57 liters per minute was placed stationary in front of the steel pan. The steel pan containing 65USG\246liters of heptane fuel on top of a layer of water was than ignited and allowed to preburn for 60 seconds. The discharge valve at the holding tank was opened and the media was applied in a stationary discharge fashion to the surface of the fire, until extinguishment. The total media applied to the fire was less than 9.6USG\36.4 liters or 0.288USG\1.092 liters of product. No reignition occurred.

* TM

The formulation in EXAMPLE 1, has been laboratory tested under Boeing, Douglas, Aerospace and US Military specifications, and recieved certification on August 08, 1995. These formulations are effective as a fire-suppressant foam, exterior aircraft cleaner, general cleaning agent, household all purpose cleaner, hand soap, and dishwashing liquid.

According to laboratory tests conducted under Boeing, Douglas, Aerospace and US Military test specifications, formula as shown in EXAMPLE 1, does not corrode or cause hydrogen embrittlement to the following materials; Aluminum alloy, Alclad aluminum alloy, Anodized aluminum alloy, Bare anodized aluminum alloy, Brass, Copper, Magnesium alloy dichromate treated, Stainless steel, Titanium steel, and Carbon steel. The formulation does not craze or discolor leather, vinyl, rubber, plastic and acrylite materials, is non-corrosive and non-abrasive.

6 % of the concentrate mixture of EXAMPLE 2, was added to synthetic sea water to provide 20 liters of solution. The dilute solution was agitated and placed into a suction tank. A suction line from the tank was installed to a electrical driven mechanical centrifugal pump. A nozzle with a restriction orifice having 0.071" bore, was connected to a 1" diameter discharge line. A steel pan with the following configuration, 480mm by 480 mm by 150 mm was utilized, and 2 liters of gasoline and 1 liter of diesel fuel was poured on top of 2 cm of water into the pan. The pan was ignited, the pump was started maintaining 150Psig discharge pressure, and the fire was attacked with the foam substance and extinguished in less than 9 seconds. After fire extinguishment no self reignition occurred.

14 % of the mixture of EXAMPLE 3, was added to distilled water to provide 4 liters of dilute solution. The dilute solution was than placed in a 5 litre fire extinguisher container and the container was than pressurized with nitrogen at 195 psig. The nozzle described above was installed on the extinguisher outlet hose. A steel pan with the following configuration 480mm by 480mm by 150mm was utilized, and 500ml of gasoline and 500ml of diesel fuel was poured on top of 2 cm of water into the pan. The pan was than ignited, and 30 seconds later the fire was attacked and extinguished in under 7 seconds. After fire extinguishment no self reignition occurred.

3 to 4 drops of EXAMPLE 5, were placed on a moist sponge and used effectively as an acrylite and plastic material cleaner, with smoke stain removal capabilities.

3 to 4 drops of EXAMPLE 8, were placed on moist sponge and used effectively to clean and provide a protective shine to car interiors, such as leather, vinyl acrylic and plastic materials.

Samples of EXAMPLE 6, were tested under Boeing, Douglas, Aerospace and US Military specifications and recieved acceptance on August 08, 1995 as follows;

BOEING D6-17487 REVISION L

Sandwich corrosion test, Acrylic crazing test, Paint softening test and Hydrogen embrittlement test; CONFORMS

Specification standards; Mil-A8625 Type I; ASTM-F1110; ASTM-F1193; ASTM-F484; ASTM-F519-77, Section 7.2; ASTM-502; BAC-5882; BAC-5845; BAC-5795; BMS 10-60 and BMS 10-100.

DOUGLAS AIRCRAFT CSD # 1

Effect on painted surfaces test; Resedue test; Sandwich corrosion test; Stress crazing test on acrylic plastics; Immersion corrosion test; Cadnium removal test and Hydrogen embrittlement test; CONFORMS

Specification standards: ASTM-F502; ASTM-F-485; ASTM-484 using 4500 psi stress level; ASTM-F483 conform to Federal specification QQ-A-250/13; ASTM-F-519 Type 1C; Mil-S-18729; Mil-C-5541 and Mil-A-8625.

AMS 1526B (AEROSPACE MATERIAL SPECIFICATION)

Sandwich corrosion test; Total immersion corrosion test; Low-embrittlement cadnium plate test; Hydrogen embrittlement test; Flash point test; Effect on transparent acrylic test; Effect on painted surfaces test, and Effect on unpainted surfaces test; CONFORMS

Specification standards: ASTM-F1110 2024-T3 anodized, 2024-T3 alclad, 7075-T6 anodized, 7075-T6 alclad; ASTM-F1111; ASTM-F519 Type 1C/150hrs; ASTM-502; ASTM-485; Mil-P-25690 plastic, and ASTM-F483;

Total immersion corrosion ASTM-F483:

PANEL allowable weight change	mg/cm square/24hrs	Found
AMS 4037 aluminum alloy anodized as in AMS 2470	0.3	0.01
AMS 4041 aluminum alloy	0.3	0.01
AMS 4376 magnesium alloy dichromate treated as in AMS 2475	0.2	0.01
AMS 4911 titanium alloy	0.1	0.01
AMS 5045 carbon steel	0.8	0.01

FOLLOWING ARE EXAMPLES of Fire-suppressant-foam dispersant and detergent analyte physical properties in accordance with the present invention.

The composition of EXAMPLE 1, exhibits the following general physical properties;

Flash point	Not Flammable
Density	1.086 Kg/L
Boiling Point	31.0 C
Viscosity cps @ 20 C	290
pH	10.7
Pour Point	- 16 C
Freezing Point	< - 20 C
Miscebility	No separation
Solubility	Complete

Foam Density 3 %	0.2426 g/ml	Foam Density 6 %	0.2761 g/ml
Foam Density 9 %	0.3593 g/ml	Foam Density 14%	0.3368 g/ml

Foam was produced by mixing the specified % of sample with 100ml distilled water shaking it vigorously in a one litre container. Weight per volume foam produced was measured immediatly and expressed in g/ml.

The composition of EXAMPLE 2, exhibits the following general physical properties;

Flash point	Not Flammable
Density	1.140Kg/L
Boiling Point	81.0 C
Viscosity cps @ 20 C	400
pH	8.0
Pour Point	- 11 C
Freezing Point	≤ - 20 C
Miscebility	No separation
Solubility	Complete

Foam Density 3 %	0.0903 g/ml	Foam Density 6 %	0.0981 g/ml
Foam Density 9 %	0.0951 g/ml	Foam Density 14%	0.1014 g/ml

Foam was produced by mixing the specified % of sample with 100ml distilled water shaking it vigorously in a one litre container. Weight per volume foam produced was measured immediatly and expressed in g/ml.

The composition of EXAMPLE 3, exhibits the following general physical properties;

Flash point	Not Flammable
Density	1.080 Kg/L
Boiling Point	83.0 C
Viscosity cps @ 20 C	220
pH	9.6
Pour Point	- 16 C
Freezing Point	< - 20 C
Miscebility	No separation
Solubility	Complete

Foam Density 3 %	0.0885 g/ml	Foam Density 6 %	0.0926 g/ml
Foam Density 9 %	0.0941 g/ml	Foam Density 14%	0.0966 g/ml

Foam was produced by mixing the specified % of sample with 100ml distilled water shaking it vigorously in a one litre container. Weight per volume foam produced was measured immediatly and expressed in g/ml.

The composition of EXAMPLE 4, exhibits the following general physical properties;

Flash point	Not Flammable
Density	1.032 Kg/L
Boiling Point	109 C
Viscosity cps @ 20 C	310
pH	12.8
Ionic activity	None
Freezing Point	> - 13 C
Miscebility	No separation
Solubility	Complete

In use, the fire suppressant detergent foam of this invention is applied in varied ratio of the designated concentration by hand-line, monitors, proportioners, high expansion mechanical foam applicators and water foam sprinkler systems. The expansion ratio of the foam can be 1 to 800 or more. The types of water which can be utilized for fighting fire range from hard to soft, fresh or salt, brackish or water contaminated with industrial waste. Fire foam application procedures vary from hand line inductor or master-stream appliance. In straight stream methods of application the foam stream should be directed towards a solid object to reflect the pattern and effect the streams velocity. The bump and roll method can also be applied in reflecting a surface in front of the area where the fire is concentrated. This action causes the foams agitation to increase making

a stronger stable blanket. The arc method of application is applied when the stream is directed in a high arc fashion so that the foam falls onto the burning surface.

In actual trials it has been demonstrated that the composition of the invention clings to vertical and curved surfaces, emulsifies hydrocarbons, and is effective on low flash point flammable liquid fires. The formula is slow draining, halon free, fluorocarbon free, non-caustic, ammonia and phosphate free. The formula achieves a surface covering fluid blanket. The formula provides a rapid initial reduction of heat radiation, and is resistant to fire re-establishment. The formula is suitable for aircraft fire fighting. The formula is film forming, provides a stable foam blanket, and has a high expansion rate. The foam fluidity is exellent, and the foam flows around obstructions and achieves total surface coverage. The foam stability is exellent; it has a high moisture content with low drainage time, and long lasting slow dissipation. Clingability is exellent, and the foam adheres to horizontal, vertical and curved surfaces. Fuel sealing capabilities are exellent, as the foam forms a stable emulsion film, suppresses hazardous and flammable gas vapours, prevents reignition, disperses hydrocarbon fuels, alcohol and solvents, is not harmful to human health, and leaves no contaminated residue. The formulation has no flash point and is non-flammable, does not harm any painted surfaces, does not harm unpainted surfaces, nor does the formulation leave any damaging resedues.

Extinguishment is exellent. The formula achieves rapid fire knockdown within the specified time frame and under Underwriter Laboratories simulated test procedures for 90 % control, extinguishment and 20 % burnback.

The actual percentage of the formulation used with water, in order to apply the formulation as a fire foam, oil dispersant, flammable liquid dispersant or clean up agent varies from application to application.

When used as an oil spill dispersant at sea it does not require special handling equipment. The most common pressure equipment aboard ships, boats or tugs is the fire fighting system providing the most effective means to not only apply the dispersant, but to supply the necessary agitation required for successful dispersion. This eliminates the dependency upon rough sea conditions for agitation. The foam formulation does not require special safety applications or personal special safety precautions, and it does not require specially designed expensive pumps, nozzles, to successfully disperse oil and flammable liquid spills, and greatly reducing the chance of ignition.

Use as a general purpose cleaning agent, it does not require special equipment, or protective clothing.

In concentrate, superconcentrate or quad form, the composition has a specific composition to water ratio, depending upon the application.

The embodiments of the invention in which an exclusive property or privelege is claimed are defined as follows.

1. A concentrate for use as a Fire suppressant foam, dispersant and detergent, when used with water, comprising (in approximate percentages by wt.):

(a) 12.00 - 34.90 % of a cocoonut fatty acid diethanolamide;

(b) 1.75 - 22.00 % of a surfactant, selected from the group consisting of an N-dialkyl-amino acid, said acid having from 2-6 carbon atoms, an lauric acid diethanolamide, sodium lauryl sulfate and sodium dioctyl sulfosuccinate;

(c) 1.75 - 7.00 % of a nonionic surfactant, selected from the group of hydrophilic ethelene oxide to hydrophobic nonyl phenol (C2 - C4 alkoxylate);

(d) 1.75 - 8.00 % propylene glycol;

(e) 1.75 - 16.00 % of a sodium lauryl sulphate, selected from the group having 30 % and 40% strenght;

(f) 8.75 - 25.00 % of a surfactant, selected from the group of glycol ethers, H (CH2) 11-15 O (CH2CH2 O) xH alkoxy polyethelene oxyethanol (x having from 7-10 moles of CH2CH2 O);

(g) 3.50 - 49.50 % % of anionic surfactant, selected from the group of alkylarylalkoxy potassium salt, having 50% strenght;

(h) 3.50 - 12.00 % surfactant, selected from the group of nonionic hydroxypolyoxyethelene surfactants, poly (oxy - 1, 2 - ethanediyl), a-(4-nonylphenyl) - w - hydroxy - , branched nonylphenoxypolyethoxyethelene;

(i) 0.10 - 0.50 % of a food color, selected from a group having constitution index numbers, 16035, 19140, 42090 and 45430;

(j) 8.00 - 65.00 % distilled water;

The percentages being selected to total 100 % of the concentrate being in the form of a pumpable liquid.

2. A composition for use as a Fire suppressant foam, dispersant and detergent, when used with water, comprising (in approximate percentages by wt.):

(a) 12.00 - 34.90 % emulsifier, of the type of cocoonut fatty acid diethanolamide;

(b) 1.75 - 22.00 % detergent builder, an amido propyl-N amino acid, (C2 - C6 amino acid);

(c) 1.75 - 7.00 % sanitizer and destaticizer, of the type of a nonionic hydrophilic alkoxylate ethelene oxide, to hydrophobic nonyl phenol, (C2 - C4 alkoxylate);

(d) 1.75 - 8.00 % freezing point depressant, propylene glycol;

(e) 1.75 - 16.00 % antibacteriostat, detergent stabilizer for low temperature clarity and uniform particle size, sodium lauryl sulphate 30% and 40% strenght;

(f) 8.75 - 25.00 % anti-corrosion inhibitor and stabilizer, (glycol ethers), alkyloxy polyethelene oxyethanol;

(g) 3.50 - 49.50 % wetting agent and detergent builder, anionic surfactant alkylaryialkoxy potassium salt 50% strenght;

(h) 3.50 - 12.00 % heat transfer agent, of a nonionic hydroxypolyoxyethelene, poly (oxy - 1, 2 - ethanediyl 0, a - (4 - nonylphenyl) - w - hydroxy - , branched nonylphenoxypolyethoxyethelene;

(i) 0.10 - 0.50 % color code, a food color having constitution index numbers 16035, 19140, 42090 and 45430;

(j) 8.00 - 65.00 viscosity adjuster, distilled water.

The percentages being selected to total 100% of the composition being in the form of a pumpable liquid.

3. A concentrate composition for use as a Fire Suppressant Foam generator, when used with water, comprising (in approximate percentages by wt.):

(a) 34.90 % cocoonut fatty acid diethanolamide;

(b) 5.00 % amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);

(c) 5.00 % nonylphenol (C2 -C4) alkoxylate;

(d) 5.00 % propylene glycol;

(e) 5.00 % sodium lauryl sulphate, 30 % strenght;

(f) 25.00 % polyethelene glycol ethers;

(g) 10.00 % alkylarylalkoxy potassium salt, 50% strenght;

(h) 10.00 % alkylphenol-hydroxypolyoxyethelene;

(i) 0.01 % color code, constitution index number 16035.

4. A concentrate composition for use as a Fire Suppressant Foam generator, when used with water, comprising (in approximate percentages by wt.):

(a) 22.00 % amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);

(b) 8.00 % sodium lauryl sulphate, 30% strenght;

(c) 49.50 % alkylarylalkoxy potassium salt, 50% strenght;

(d) 12.00 % nonylphenoxypolyethoxyethelene;

(e) 8.00 % distilled water;

(f) 0.50 % color code, constitution index number 16035.

5. A concentrate composition for use as a Fire Suppressant Foam generator, when used with water, comprising (in approximate percentages by wt.):

(a) 12.00 % cocoonut fatty acid diethanolamide;

(b) 11.00 % amidopropyl-N dimethylamino acid (C2 - C6 amino acid);

(c) 7.00 % nonylphenol (C2 -C4) alkoxylate;

(d) 8.00 % propylene glycol;

(e) 16.00 % sodium lauryl sulphate, 30% strenght;
(f) 15.50 % polyethelene glycol ethers;
(g) 20.00 % alkylarylalkoxy potassium salt, 50% strenght;
(h) 10.00 % alkylphenol-hydroxypolyoxyethelene;
(i) 0.50 % color code, constitution index number 42090.

6. A concentrate composition for use as a Fire Suppressant Dispersant, when used with water, comprising (in approximate percentages by wt.):

(a) 27.90 % cocoanut fatty acid diethanolamide;
(b) 4.00 % amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);
(c) 4.00 % nonylphenol (C2 -C4) alkoxylate;
(d) 4.00 % propylene glycol;
(e) 4.00 % sodium lauryl sulphate, 30% strenght;
(f) 20.00 % polyethelene glycol ethers;
(g) 8.00 % alkylarylalkoxy potassium salt, 50% strenght;
(h) 8.00 % alkylphenol-hydroxypolyoxyethelene;
(i) 0.10 % color code, constitution index numbers 42090 and 19140;
(j) 20.00 % distilled water.

7. A concentrate composition for use as a Fire Suppressant Detergent and Dispersant, when used with water, comprising (in approximate percentages by wt.):

(a) 24.40 % cocoanut fatty acid diethanolamide;
(b) 3.50 % amidopropyl-N dimethylamino acid, (C2 -C6 amino acid);
(c) 3.50 % nonylphenol (C2 - C4) alkoxylate;
(d) 3.50 % propylene glycol;
(e) 3.50 % sodium lauryl sulphate, 40% strenght;
(f) 17.50 % polyethelene glycol ethers;
(g) 7.00 % alkylarylalkoxy potassium salt, 50% strenght;
(h) 7.00 % alkylphenol-hydroxypolyoxyethelene;
(i) 0.10 % color code, constitution index number 45430;
(j) 30.00 % distilled water.

8. A concentrate composition for use as a Fire Suppressant Detergent and Dispersant, when used with water, comprising (in approximate percentages by wt.):

(a)	20.90 %	coconut fatty acid diethanolamide;
(b)	3.00 %	amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);
(c)	3.00 %	nonylphenol (C2 - C4) alkoxylate;
(d)	3.00 %	propylene glycol;
(e)	3.00 %	sodium lauryl sulphate, 30% strenght;
(f)	15.00 %	polyethelene glycol ethers;
(g)	6.00 %	alkylarylalkoxy potassium salt, 50% strenght;
(h)	6.00 %	alkylphenol-hydroxypolyoxyethelene;
(i)	0.10 %	color code, constitution index number 16035;
(j)	40.00 %	distilled water.

9. A concentrate composition for use as a Fire Suppressant Detergent, when used with water, comprising (in approximate percentages by wt.):

(a)	13.90 %	coconut fatty acid diethanolamide;
(b)	2.00 %	amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);
(c)	2.00 %	nonylphenol (C2 - C4) alkoxylate;
(d)	2.00 %	propylene glycol;
(e)	2.00 %	sodium lauryl sulphate, 40% strenght;
(f)	10.00 %	polyethelene glycol ethers;
(g)	4.00 %	alkylarylalkoxy potassium salt, 50% strenght;
(h)	4.00 %	alkylphenol-hydroxypolyoxyethelene;
(i)	0.10 %	color code, constitution index number 42090;
(j)	60.00 %	distilled water.

10. A concentrate composition for use as a Fire Suppressant Detergent, when used with water, comprising (in approximate percentages by wt.):

(a)	12.15 %	coconut fatty acid diethanolamide;
(b)	1.75 %	amidopropyl-N dimethylamino acid, (C2 - C6 amino acid);
(c)	1.75 %	nonylphenol (C2 - C4) alkoxylate;
(d)	1.75 %	propylene glycol;
(e)	1.75 %	sodium lauryl sulphate, 30% strenght;
(f)	8.75 %	polyethelene glycol ethers;
(g)	3.50 %	alkylarylalkoxy potassium salt, 50% strenght;
(h)	3.50 %	alkylphenol-hydroxypolyoxyethelene;
(i)	0.10 %	color code, constitution index number 19140;
(j)	65.00 %	distilled water.

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/CA 96/00539

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A62D1/00 C11D1/86 C02F1/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A62D C11D C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 308 550 (FRILOUX EDWARD E) 3 May 1994 ---	
A	WO,A,91 00138 (DELTA OMEGA TECHNOLOGIES LTD) 10 January 1991 ---	
A	CA,A,1 337 011 (ENVIRONMENTAL SCIENCE INTERNAT) 19 September 1995 ---	
A	US,A,5 061 383 (FRILOUX EDWARD E ET AL) 29 October 1991 ---	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 January 1997	04. 02. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Dalkafouki, A

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INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/CA 96/00539

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CHEMICAL ABSTRACTS, vol. 98, no. 14, 4 April 1983 Columbus, Ohio, US; abstract no. 109967, NEW JAPAN CHEMICAL CO., LTD., JAPAN: "Foam fire extinguishers" XP002023448 see abstract & JP,A,57 164 073 (NEW JAPAN CHEMICAL CO., LTD., JAPAN) ---	1
A	EP,A,0 598 143 (DELTA OMEGA TECHNOLOGIES LTD) 25 May 1994 -----	

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INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/CA 96/00539

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		EP-A- 0434830	03-07-91
CA-A-1337011	19-09-95	NONE	
US-A-5061383	29-10-91	NONE	
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		DE-A- 4238424	19-05-94
		JP-A- 6234999	23-08-94